DOCUMENT RESUME

ED 070 757 SP 005 981

AUTHOR	Shapson, Stanley M.
TITLE	Optimum Class Size? A Review of the Literature.
SPONS AGENCY	Toronto Board of Education (Ontario). Research Dept.
PUB DATE	Nov 72
NOTE	22p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Classroom Arrangement; *Class Size; Flexible Scheduling; *Student Attitudes; *Student Behavior; *Student Teacher Ratio; *Teacher Attitudes; Teaching Methods

ABSTRACT

This document reviews the research literature concerning class size and related issues raised by the research. The literature is divided into major areas of concern: lack of a consistent definition, criterion to be measured, the relationship between class size and method of instruction, teachers' and pupils' attitudes on class size, class size and the behavior of pupils, review of class size studies by researchers at Columbia University, different interpretations of class size literature, and flexible policies. The summary indicates inconclusive findings; however, five factors affecting optimum class size were stressed. These factors include the criteria of success, the original class size, the subject being taught, whether or not the teacher can exploit the potential of smaller classes by using an appropriate method of instruction, and the teachers' feelings and attitudes. A 20-item bibliography is included. (MJM)

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OPTIMUM CLASS SIZE?
A REVIEW OF THE LITERATURE

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SP 005 981

November/72

PREFACE

What does research say about the subject of optimum class size? On July 27, 1972·

> "Trustee Barnes, seconded by Trustee Beach, moved that the Director of Education be requested to prepare, for the information of the Board, a summary of reports (those which the Director of Education considers to be the best researched) on research studies which are available on the subject of optimum class size. The motion was carried."
>
> (Minutes of the Board, July 27, 1972, p. 563)

To meet the above request the following document was prepared by the Research Department and forwarded to the trustees by the Director on October 26, 1972.

Because of the current concerns and publicity surrounding "class size," it was felt that this report would be of general interest and should be made readily available. Therefore, it is being reproduced as a Research Department report.

The document highlights numerous issues raised by the research on class size. It attempts to show that the question of class size is a complex one which should not be dealt with in isolation from other important factors in education.

S. M. Shapson,
Research Associate.

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OPTIMUM CLASS SIZE?
A REVIEW OF THE LITERATURE

Many studies have focused attention on the relationship between class size and learning in the classroom. In the most recent study available Flinker (1972) measured the growth in mathematical and language arts skills in a "large" class (55 pupils) and two "small" classes (34 pupils) in the seventh grade. Standardized achievement tests were used to assess mathematical and language art skills twice during the school year. The results indicated significant improvements for the "large" class but not for the "small" classes.

Contrary to prevalent opinion, these results seem to indicate higher achievement in a larger than a smaller group. However, before accepting these results at face value, a careful analysis of the design of the above study is necessary.

First of all, it should be noted that the large group was instructed by the department chairman in each area. As a result the quality of instruction in the large class may have been better than in the small classes. Second, the teachers of the large class had educational assistants in the classroom. These paraprofessionals corresponded with parents, checked attendance, and administered, and marked tests and assignments. Because of this assistance, it is likely that the teachers of the large class had more time for actual interaction with the students.

Are the results obtained in Flinker's study attributable to the effects of class size, or quality of instruction or teacher load? Because of the inadequacy of the experimental design, this question cannot be answered.

Little, Mabey and Russell (1971) pointed out that in several British investigations, students in larger classes attained slightly better scores on reading tests than those in smaller classes. However, these results could have been at least partly due to the following factors which had not been controlled:

(a) an urban/rural difference: larger schools were in the cities and large classes were found in large schools;

(b) school policies of putting less able children in smaller classes;

(c) school policies of giving inexperienced and younger teachers the smaller groups and the more proficient teachers the larger ones.

Unfortunately, many of the studies, reporting higher levels of achievement in smaller than in larger classes, suffer from methodological weaknesses as well. Once again it is difficult to draw unequivocal or clear-cut conclusions from these studies.

The above illustrations and introductory remarks are not intended to argue in favour of either small or large classes. Rather they are intended to demonstrate at the outset that the issue of class size is much more complex than appears at first glance. Numerous factors moderate the relationship between class size and learning in the classroom. Most of the research on class size has not been comprehensive. Many factors or variables must be accounted for. By failing to control for these variables, inconsistent results have been obtained between studies and it is difficult to get to the heart of the effects of class size itself.

Lack Of A Consistent Definition

One difficulty encountered in examining the existing research is the lack of a consistent definition of class size. Some studies have

considered "class size," others "class load" and still others some type of "staffing ratio." In a report prepared by the Educational Policies Committee of the New York State Teachers' Association (1959) the above terms were defined as follows:

> "Class size is the number of students assigned to a teacher for a period of instruction. In elementary schools, where one teacher directs all learning, it is the number of pupils for whom a teacher is responsible daily. In secondary schools or other schools in which teachers are responsible for instruction in a particular subject, it is the number of pupils for whom a teacher is responsible during a single period.
>
> Class load is the number of pupils for whom teachers are responsible daily where the teacher is assigned more than one class each day.
>
> Staffing ratio represents the ratio of professional staff (supervisors, administrators, teachers and professional personnel) to pupils. It should be understood that a school system may have a large class size and yet have a relatively low ratio of pupils to staff positions."
>
> (New York Teachers' Association, 1959, p. 11)

The use of class size and staffing ratio interchangeably is one main source of confusion. In some studies the variable measured has been all personnel resources contributing to achievement; in other studies the measure was based only on the classroom teacher. Another issue to be resolved concerns the relationship between class size and class load. For example, which is preferable: four classes of 30 or five of 24?

Criterion To Be Measured: The Effect Of Class Size On What?

An essential question which must be answered is the following: What criteria of success should be used? Achievement as measured by a standardized test is only one product of the educational environment on which the effects of class size can be assessed. An achievement test generally measures a highly specialized type of learning and as such

represents only one part of what the school is trying to achieve. In a review of the literature on the effects of class size, Sitkei (1968) pointed out that educators generally agree that factual learning is not the only goal of education. Based on his literature review, Sitkei concluded that concern about a pupil's personal, creative and social development does support a plea for reasonable class sizes.

The Relationship Between Class Size And Method Of Instruction

Method of instruction is one of the many variables which should be taken into account in research on class size. The Encyclopedia of Educational Research offers the opinion that:

> "Any criterion employed to assess the effect of class size is in actuality assessing the accomplishments of some method -- the method of teaching which was used in the study in question. Whether it appears to better advantage in large classes or in small classes depends upon the compatibility of the method with the size of the groups being investigated. One is at a loss to know, with respect to virtually all the class-size literature, whether the research design specifies a method for either or both of the class-size categories and whether the method specified was actually consistently employed."
>
> (Encyclopedia of Educational Research, 1969, p. 142)

In a report published by the New York State Teachers' Association (1959), it was suggested that teachers advocate smaller classes because with smaller classes they have more time to experiment, to initiate and perfect more effective methods of instruction. Teachers felt that they were forced to use routine methods when they were assigned larger classes. It was suggested that in large classes attention became centred upon achieving a reasonable group norm rather than stimulating each pupil to advance according to his capacity (New York State Teachers' Association, 1959, p. 14).

McKenna and Pugh (1964) actually studied the degree to which instruction was individualized in small classes (10 to 20) and large classes (30 to 43). The method used in the study was field observation conducted by experienced educators. The observers used a standardized guide designed to focus attention on the criterion of the study -- the individualization of instruction in the teaching and learning function.

McKenna and Pugh found that a greater number and variety of activities took place in the small than in the large groups. Moreover, a significantly greater percentage of ac ivities in the small classes was devoted to individual and small group instruction. However, they also pointed out that a considerable amount of instruction in the small classes was still mass oriented.

Danowski (1965) carried out another study to determine whether or not teachers were taking advantage of small classes by individualizing their instructional procedures. Danowski's results, as summarized in the Encyclopedia of Educational Research (1969), revealed that only about one-half of the teachers of the small classes (20 or fewer pupils) used individualized teaching methods.

Evidence from the above studies indicates that not all teachers automatically take advantage of the opportunity for individualization of instruction that small classes afford. It is unlikely that the same teaching method is best for all situations. If the same teaching techniques are used in both groups, it is likely that no difference would be found in large and small classes. McKenna and Pugh suggest that teachers have been taught and have developed skills and techniques of teaching that are applicable only to large classes of pupils. When the opportunity arises to work with a small class, they are not equipped to make the most of this

opportunity. McKenna and Pugh feel that special training must be provided for teachers so that they will be able to fully capitalize on the opportunities afforded in small classes (McKenna and Pugh, 1964, p. 4).

Teachers' Attitudes on Class Size

In the report by the New York State Teachers' Association (1959), it was suggested that since research has not been conclusive, teacher judgement and attitudes should be considered in determining class size. In a general opinion poll conducted by the NEA Research Division (1961), the following question was asked: "In your opinion what is the best size for most elementary-school classes for effective teaching?" It was discovered that about two-thirds of the teachers and principals included in the sample believed that a class should have no more than 24 pupils.

A positive relationship also has been found between class size and the amount of nervous strain reported by teachers (New York State Teachers' Association, 1959). Elementary teachers who felt little or no nervous strain had an average class size of about 26. Teachers who felt the greatest amount of nervous strain had an average class of over 29. Teachers who expressed the most dissatisfaction with teaching also tended to have larger classes, over 30 pupils on the average, as compared to about 27 pupils for the teachers who were most satisfied.

It was also discovered that secondary teachers who felt considerable nervous strain had a heavy class load (about 136 pupils daily). Those who reported little or no strain had an average of about 115 pupils daily. Secondary teachers who were most dissatisfied with their jobs also had a high class load (nearly 131 pupils daily).

In a study reported by Cannon (1966), a teacher kept a diary to record her feelings and reactions in directing two groups of kindergarten

children: a small group (23 to 28 pupils) and a large group (34 to 39 pupils). As noted in her daily diary, the large group was often termed hard to handle, noisy and chaotic, with the teacher exhausted by the end of the day. The teacher also experienced greater satisfaction, more enjoyment and a higher sense of achievement when working with the small group.

In a recent poll by the National Education Association, cited in the Report on Education Research (October 11, 1972), teachers were asked to select the most significant teaching problems. Four instructional situations emerged as "serious" or "critical": the wide range of student achievement, student indifference, the weight of non-teaching chores, and the number of students per teacher.

Students' Attitudes On Class Size

Although teachers have been asked to express their attitudes and opinions on class size, there has been little, if any, attempt to do the same with elementary or secondary school students. In a study involving a college population, Eash and Bennett (1964) interviewed students to obtain opinions about large lecture groups versus small lecture-discussion classes. The pattern of instruction influenced students' perceptions of the instructor and his techniques. Students in the large lecture group tended to perceive the lecturer primarily as a disperser of information; those in the smaller groups saw the instructor in many different roles. The responses of students in the large classes reflected a lack of personal contact with the instructor and the inability to express their own ideas and feelings to him.

Class Size and the Behaviour of Pupils

Attention has also been given to the behaviour of pupils in classes of different sizes. Based on a survey of 2,000 elementary school teachers, Hubbard (1963) reported that there were more behaviour problems in large classes than in small ones.

In another study, Cannon (1966) described the behaviour of kindergarten children in a small class (23 to 28 pupils) and a large class (34 to 39 pupils). More aggressive acts such as pushing, bumping, crowding and striking were found in the large group than in the small group. It was also reported that a higher level of frustration appeared to precede the general climate of aggressive behaviour. The teachers of the large group had fewer opportunities to guide pupils individually in order to minimize the negative behaviours.

In large classes, effective teaching time may be spent in disciplining the group. Furthermore, in such situations teachers may be unable to diagnose the underlying causes of an individual's misbehaviour.

Review Of Class Size Studies by Researchers At Columbia

Vincent (1968) pointed out that there had been no previous attempt to establish the dimension of largeness and smallness in studies dealing with class size. One of the weaknesses of the bulk of the class size research has been the lack of agreement on the quantitative dimensions of the terms employed. The size range that in one study is viewed as "small" turns out to be large in some other study. For example, in Flinker's (1972) study which was cited earlier in this report, the "small" group was a class of 34 pupils. However, in the study described by Cannon (1966) the "large" group contained between 34 to 39 pupils.

A major characteristic of the research carried out in Columbia (Olsen, 1970; Vincent, 1968) is its concern with optimum class size. One of the questions posed by the Columbia group was the following:

> "Is the class size pupil benefit relationship smooth and linear or is there -- as seems more likely -- some critical break point such that change in class size above and below this optimum has little effect."
>
> (Vincent, 1968, p. 1)

The most extensive of these investigations entitled "Classroom Variables That Predict School System Quality" (Olsen, 1970) involved nearly 20,000 classrooms from a wide variety of school districts in the United States.* The intent of the study was to identify the specific effect of eleven different classroom variables on the general quality of education being offered.

Class size was one of the eleven variables. Some of the other classroom variables were: subject being taught, style of educational activity (e.g., lecture, seat work, individual work, small group work, discussion), grade level, number of adults in the classroom, sex of the teacher, and day of the week.

The measure of the general quality of the educational process, "Indicators of Quality" (Olsen, 1970), has been developed over a period of seven years and was designed to assess a classroom on four criteria: individualization, interpersonal regard, group activity and creativity. Trained observers, using a structured observation guide, obtained data that were converted to a single quality score for each situation they observed.

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* Specifically 18,528 classroom observations were conducted in 112 largely suburban school districts located in 11 metropolitan regions across the United States. There were approximately 1,000 more elementary than secondary classes.

The results revealed that the style of educational activity was the strongest predictor of educational quality. High scoring styles were small group work, individual work, discussion, laboratory work, pupil report and demonstration. Lowest scoring styles were lecture, question/answer, seat work, tests, and movies. It was also noteworthy that teachers relied heavily on the less effective styles.

The second strongest predictor was subject taught. The third was class size. The relationship between class size and quality of education score was clear: smaller classes had significantly higher scores than larger ones.

In addition, the data revealed optimum class sizes in relation to the quality of the educational process. Critical break points were found; these were points in the continuum of class size where sharp drops occurred in the quality scores. For the elementary classes, there were three such points: between class sizes of under 5 and 5 to 10, between 11 to 15 and 16 to 20, and between 21 to 25 and 26 to 30. For the secondary classes, there were two clear cut breaking points, one on each side of the 11 to 15 group. Olsen (1970) suggests that school systems may consider altering their class size ratios if they are close to and on the wrong side of a critical break point.

Another interesting statistic from the above study was that 56 per cent of the classes at the elementary level and 74 per cent at the secondary level had fewer than 26 pupils.

Two important features of the research described above should be emphasized. The first is the use of a wide range of class sizes instead of the usual practice of arbitrarily choosing one size to represent "large" and a second to represent "small." This approach should be incorporated into future class size research.

The second feature is the use of a number of variables in addition to class size. Aside from determining the over-all effects of these variables, this feature permitted an analysis of the effects of class size in combination with other significant predictors of the "quality of education." This enabled assessments of the influences of class size on, among other things, certain subjects and certain teaching styles. Highlights of some of these findings (in the elementary classes) are presented below:

- a stronger relationship was found between class size and the quality score for mathematics, social studies and science than for reading and language arts. However, these results may be partly attributable to style of teaching since the frequency of small group work and individual work was greater for reading than for any of the other subjects regardless of class size.

- small group work (the highest scoring teaching style) was equally effective in all classrooms containing fewer than 35 pupils. This was in direct contrast with lecture (the lowest scoring style) which had higher quality scores in classes of less than 21 pupils than in classes of more than 30 pupils.

- individual work was associated with much lower quality scores as class size increased. Furthermore, teachers' use of individual work increased in classes of up to 25 pupils.

- laboratory work, class discussions and pupil report were styles of activity which stacked up well on the quality of education criterion even with class sizes as high as 50.

In the above research, no information was available on the policies of individual school boards. For example, although classes were sampled from a number of metropolitan regions throughout the United States, the possibility exists that the majority of the smaller classes were found in richer school boards. Richer boards may also have attracted better qualified teachers and had available more finances for instructional aids, as well as having a different type of pupil. If any of the above factors were true, then it would be difficult to establish the degree to which the results can be attributed to class size.

Evidence from an earlier study indicates that a school board's staffing policy is an important factor. McKenna (1965) discovered that the staff measure which assisted most in predicting quality of education scores was total number of professional staff members rather than class size itself. However, it is noted that in the Columbia research the variable under consideration was simply class size.

The Columbia research examined the effects of class size on the quality of education. The quality measure was obtained by observing events occurring in the classroom. No attempt was made to determine how much the pupils learned.

Different Interpretations of Class Size Literature

Recently, a report entitled "Class Size and Pupil-Teacher Ratio: An Annotated Bibliography" has been published by the British Columbia School Trustees Association (1970). Using this report, in which 42 studies were reviewed, different people have come to different conclusions and have made different suggestions. For example, according to Burbidge (1970) the following conclusions were expressed in the British Columbia School Trustees Association Newsletter (of September 10, 1970): (a) the only recurring note in the annotated studies was that class size improves teacher morale, and (b) since the research was inconclusive, the class size status quo could be retained in British Columbia schools.

Burbidge's (1970) own opinion, based on his review of the annotated bibliography, was that:

> "...if it is individualized rather than mass education which is desired, then it is essential that the average class size prevailing in the schools of this province be reduced considerably."
>
> (Burbidge, 1970, p. 13)

The above discussion once again brings to mind questions about the criteria of success. People with different sets of educational objectives or priorities tend to interpret the class size literature differently.

Flexible Policies

Flexibility in class size policy has been adopted with favourable results in a recent study. Balow (1967) reported on an experiment which was carried out on the assumption that reading instruction provided in small classes is more effective than in large classes. A 50 per cent reduction in class size was accomplished by having half of the pupils in a number of classes come to school at 9 o'clock in the morning. These pupils received instruction in reading until 10 o'clock when the rest of the class arrived. The latter group received its reading instruction in the last hour of the afternoon after the first group had gone home. As a result each child was in school 25 fewer minutes per day and the teacher taught an extra 25 minutes per day. Class size for reading instruction was reduced from 30 students in the average class to 15 in the experimental programme. Briefly, the results revealed that the experimental group achieved significantly higher in reading than the control group (i.e. the regular classes of 30 pupils).

Although not directly related to class size, a flexible programme, introduced as a "desperate" solution to budget cuts, was described recently in Report on Education Research (September 27, 1972). The programme which was set up in a Maine school district consisted of a four-day week with teachers using the Fridays off for in-service training to study techniques of individualizing instruction. The budget cuts were passed on to the schools in the form of cuts in heating, lighting, operation of the cafeteria and transportation. To make up for some of the lost time, the four school days were lengthened by 35 minutes. Student achievement changes were

measured during the year and a study of community attitudes was conducted. Based on the favourable results and a satisfied community, it was decided to continue the project for another year. It was also reported that for the first time in three years, the taxpayers approved the budget almost as submitted.

Summary

In general, the research on class size has not been conclusive when achievement measures were used as criteria. Some studies have found that small classes are better, others that large classes are better, and still others have found no effect due to class size. Many variables are present in the classroom environment, such as: the pupils, the teacher, the subject matter, and the methods of instruction. The available research seems to indicate that these variables are more important than class size. Because many studies have failed to control for these variables, inconsistent results have been obtained and it is difficult to assess the effects of class size itself.

Based on the available research, it can be concluded that there is no single optimum class size applicable to all situations.

The research suggests that rather than one rigid class size policy, a flexible approach should be adopted. Class size could be appropriately altered to fit certain situations.

Flexibility can be achieved in many ways. Examples of flexible approaches which have been adopted include the use of paraprofessionals in "large" classes, and the staggering of departure and arrival times of pupils to obtain smaller groups for specific periods of instruction.

The research on class size is based on a correlational approach: a relationship is expressed between existing class sizes and some measure

of success. Since many variables must be accounted for in a school environment, one cannot predict if an obtained relationship would hold if one intervened by altering existing class sizes.

For the most part, there has been a lack of agreement on the quantitative dimensions of large and small: the size that in one study is viewed as small turns out to be large in some other study.

Research has shown that although more individualized instruction is possible with smaller classes, teachers do not necessarily take advantage of this opportunity when their classes are small.

The available research has also demonstrated that teachers have well defined attitudes and feelings about class size. The attitudes of teachers and the additional stress that a larger class implies should also be taken into account when setting class size policy. The attitudes and feelings of students on this subject are not known.

There is evidence indicating that the total number of professional staff members working with the students is a more important measure than the actual class size.

The most comprehensive study involving class size was carried out at Columbia University. Conducting observations in almost 20,000 classrooms, an assessment was made of the effects of a variety of variables on the "quality of education" offered in the classroom. The research was not concerned with the pupils' output (i.e. performance). In general, although class size was not the most important variable, the quality of education was found to be better in small classes than in large classes. However, breaking points were found; for example, it was suggested that reducing a class from 27 to 26 pupils would have no effect on the quality of education while a reduction from 26 to 25 would have a favourable effect.

The Columbia study also found out that the effect of class size depended on the subject being taught and on the method of instruction that is used.

Even in relation to the Columbia study, a simple question such as "What happens if all classes are changed by one pupil (either up or down)?" -- can only be answered by -- "it depends." It depends on

(a) the criteria of success (e.g., quality of education or pupil performance);

(b) the original size of the class;

(c) the subject being taught;

(d) whether or not the teacher can exploit the potential of smaller classes by using an appropriate method of instruction;

(e) the teachers' feelings and attitudes.

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Prepared by S. Shapson, Research Associate, for submission to the Board, October 19, 1972. Distributed to trustees with a covering letter signed by Miss G. Fatt and Dr. R. Jones, October 26, 1972.